

Chapter 20: Complex Numbers

20.1: Imaginary Numbers

Recall: In the set of real numbers we cannot take the square root of a (-).

Imaginary (not real) unit, i

$$\star i = \sqrt{-1}$$

Simplifying Imaginary #'s

1) replace the $(-)$ under the $\sqrt{}$ with an "i" directly in front of the $\sqrt{}$.

$$\sqrt{-24} = i\sqrt{24}$$

$$3\sqrt{-15} = 3i\sqrt{15}$$

$$2 + \sqrt{-8} = 2 + i\sqrt{8}$$

2) Simplify the remaining non-negative radical.

Ex: Simplify $3\sqrt{-24}$

1) replace the $(-)$: $3i\sqrt{24}$
with "i"

2) simplify the : $3i\sqrt{4 \cdot 6}$
remaining $\sqrt{\quad}$

$$\begin{array}{l} 2 \cdot 3i\sqrt{6} \\ 6i\sqrt{6} \end{array}$$

★ i behaves like any variable
 $2 \cdot 3x = 6x$; $2 \cdot 3i = 6i$

Ex: Simplify $2\sqrt{-32}$

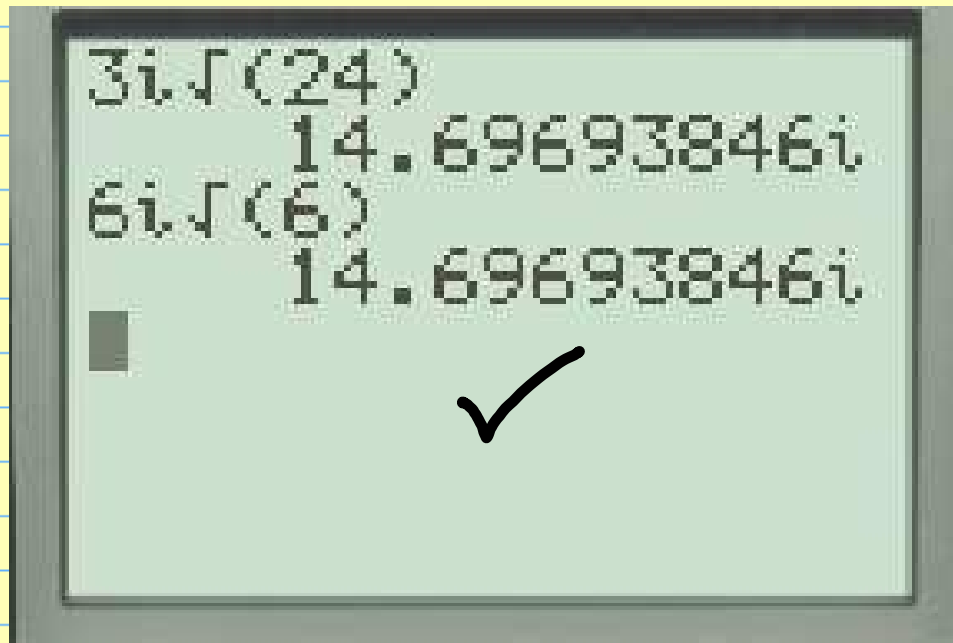
★ you can still use your calculator to check that you simplified correctly.

But you cannot type a \leftarrow under a $\sqrt{\quad}$ in the calculator, you have to bring out "i" first.

$$\begin{array}{ccc} \sqrt{-12} & = & i\sqrt{12} \\ \downarrow & & \downarrow \\ \text{no} & & \text{yes} \end{array}$$

★ "i" is 2nd . on calculator

Calculator:



you can check
that $3\sqrt{-24}$
equals $6i\sqrt{6}$

Powers of "i":

$$i^0 =$$

$$i^1 =$$

$$i^2 =$$

$$i^3 =$$

$$i^4 =$$

$$i^5 =$$

$$i^6 =$$

$$i^7 =$$

$$i^8 =$$

★ Powers of "i"
repeat in a
pattern of —.

Simplifying Powers of "i":

÷ the power by 4, if:

- no decimal = $i^0 = 1$
- .25 = $i^1 = i$
- .5 = $i^2 = -1$
- .75 = $i^3 = -i$

Ex: Express i^{257} as 1, i, -1, or -i.

Homework : Pg 924 : 3-69 (:3)

24. $4\sqrt{-\frac{1}{8}}$

51. $-3\sqrt{-10} \cdot 2\sqrt{-10}$